Q&A Panel

COL NEGRON: Before we start the Q&A, let me just remind everybody -- I said at the very beginning, we are going to have 100-percent autonomous vehicles. I said we are going to go through varied terrain, and, of course, the prize award will be given to the fastest vehicle. I did make the waiver that it is going to be inside the 10-hour block. So that is what we are looking at right now.

Hopefully, everybody has had an opportunity to write down their questions. If you can begin lining up behind the mics right here, I will move the chairs up front here, and we will start getting our team here to answer some of your questions.

Scott Fish, Sal Fish the route director, Mike Fagan the rules, Mike Mulqueen our technical director, Diane Sidebottom our legal advisor, and, of course, Jan Walker our PA person.

If I can get you to state your name and just read the question off, I will direct the question to the expert on the panel.

Are we going to alternate mics? Can I get the first question, please?

QUESTIONER: My name is Labar Askew [ph], and my [inaudible]. Are tethered sensors such as balloons or vertical lift sensor platforms considered sub-vehicles?

PANEL: Good question. Let's see. That is the reason I have my staff. Okay. You know, it takes a long time to write rules here. Did everybody hear the question? Is there anybody in the back who did not hear the question? Raise your hand. Okay, I will repeat the question. The question is: Is a tethered sensor considered to be part of the vehicle? I don't want to give an answer now, but I don't recall anything in the rules that you have in the book that prohibits that. It is attached to the vehicle. Right? I don't think you would make it under the underpass.

QUESTIONER: We will reel it in or something.

PANEL: That is a good question. I hope the rest of them are easier. I don't know. [Laughter.] It is attached to the vehicle. It is one system. Right? Good question. We will post the answer on the web. The first question and you get the prize. Okay? [Applause.] Come see me after. I will buy you a drink. All right. Our second question?

QUESTIONER: Can an individual participate on more

than one team? My name is Peter Marlow [ph].

PANEL: An individual can participate in more than one team? Yes. Next question.

QUESTIONER: Larry Mathees [ph]. I think many potential entrants will have equipment or facilities that were purchased or constructed under previous Government contracts, and I am not sure where the line is drawn about how much of that kind of equipment or facilities as legacy from previous Government work is usable.

PANEL: What we are concerned about is you using Government-furnished equipment that you have at your facility that has been given to you for other contracts. If it is equipment that you purchased for another contract, but was yours and you got to keep it at the end, then it is still yours and you can use it. Just nothing that is funded with Government money now or at the time of the race. Okay, next question in the back.

QUESTIONER: My name is Surion Saheeb [ph] from [inaudible] Communication in [inaudible] California. My question goes to the first question you already have related to sub-vehicles. What is considered to be a sub-vehicle? What if I have a vehicle that has a tow and is pulling

another vehicle? Will they be considered as one vehicle or is that going to be illegal? My second question is in the same sense, if we have an example, for instance, [inaudible], if we have individual modules which are components for the vehicle and each one of them can be individually tied to each other, what is going to be the boundaries to see -- or that DARPA will let us know about when the vehicle can be a sub-vehicle?

PANEL: I will take this one. Here is what I am going to do. The question is about tethering and [inaudible] committee. We will adjust that by 1 April and post it. We have got to go back and discuss that among the team and get our experts to really look at the depth of that question. So let me table that one, write it down, and we will answer that, hopefully, when we post it to the website. The same with the tethered question. Next.

QUESTIONER: My name is Mike Thomas. I am from Chennith [ph] Racing Products. I have two questions. The first one to Sal, is it possible that SCORE could provide insurance, a group deal such as we do in the races? Is that a possibility? Oh, come on, Sal.

PANEL: Yeah, I know. That became my question.

The Government is not going to arrange insurance coverage for you. We can't do that since you are not under contract with us. What we will do is we are going to try and find insurance companies that would be willing to cover an event like this. Now, if you have found other alternate insurance possibilities that don't seem interested -- maybe it is because they don't know what is going on or what the risk factors are with this particular race -- you can send them to us and we will answer all of their questions. But SCORE is not going to set up sort of a blanket insurance policy for all the participants. Is that your question?

QUESTIONER: Okay. The reason I asked that -- and Sal, I think understands why because as participants in off-road racing, we pay a fee that covers that insurance. I just wondered if there would be a possibility that it could be underwritten by one company, and we could all participate in that same --

PANEL: As of right now, that is not a possibility that we have thought about. We will look into it, and we will let you know whether it is something we can accomplish. Right now, I don't see it as being something that is likely to happen, but we can certainly look into it.

QUESTIONER: Okay. The second question, any technology that is disclosed, a technical paper that we [inaudible] be done?

PANEL: Yes. The answer to that is yes, and let me follow up on that. Remember, your technical paper will be published to the public after the race. So that is one. When you look at the technical paper, a lot of the proprietary information is not really in the paper itself. I know that is a concern, and we are looking into that, but we will work something out that will benefit us as well as you. Next question, please.

QUESTIONER: Mark Rosenbloom [ph] from Denver, Colorado. My first question is: What is the maximum number of questions we can ask?

PANEL: That counts as one. [Laughter.] I think you are done. You can meet me at the bar. No. You can ask two questions if you have to. I am willing to do that, just to speed it up.

QUESTIONER: Is there going to be a shakeout area or a shakeout time that we can test our vehicles that is not the racetrack?

PANEL: I don't think there is a problem with

taking your vehicle anywhere in the desert, whether it be California, Nevada, or Arizona, that allows open running prior to the event. I don't think that is our concern here at DARPA, is it? No. It is not my concern. My issue is this. Somewhere for the ribbon-cutting, on the 11th I believe, we will do that in Anaheim. We will move it to the racetrack on the 12th. Really, you are shaking the vehicle out. For us, we are really testing the vehicle if it is capable of performing the technical requirements that you have stated in your paper. Third, to me, I look at close to the first hour of the event. Really, it is too late for you guys, but for us it is really shaking the vehicle out. So those are things we are looking at. Nothing is definite. We are still planning the route, but that is how I see us stair-stepping to a solution. We are really concerned about safety, and we are really concerned to ensure that we comply with the local and state laws. Next question.

QUESTIONER: Chris Willis [ph]. I have a couple of questions. The first one, how long will it take DARPA to reply to these applications?

PANEL: Two weeks. You turn them in on the 13th, and we are trying to turn them around the 1st of November, if

possible. What we are trying to do, more than anything else, is to have an iterative process so we can work with you. Our intent is to have you qualified on the 13th. So, hopefully, we have started the engagement process with you early, but if you are turning you paper in on the 13th, you can stumble.

QUESTIONER: I thought you said papers were going to be turned in on April the 1st. What 13th are you talking about?

PANEL: He is talking about the October 13th final deadline.

QUESTIONER: Yes, I understand that. I am asking when you turn in your papers on April 1st, how long is it going to take you guys to get back to us and say, okay, you are approved, or you are not, you know, that turnaround process?

PANEL: Two weeks. Two weeks, especially if you turn them in right away. I mean, I would like to point out that we may get a lot of papers turned in on the 12th at the beginning, and we will get it back to you in 2 weeks.

QUESTIONER: Okay. The second question has to do with the insurance again. Why are we required to be insured at the time of submission of our paper and not just during

the event?

PANEL: Your insurance doesn't have to kick in until the actual time of the event. What we are asking for is that you have made arrangements to have insurance that covers you at the event. Okay. Next question.

QUESTIONER: I am David Andees [ph] from Ridgecrest, California. I have a couple of questions. I am interested in any guidance you can give us on the kind of modifications that are going to be allowed after the technical paper has been accepted. For instance, if I say I am going to use two cameras and I decide to use three, does that throw me off?

PANEL: I will turn that over to Mike. Actually, I have been asked that question a couple of times today. As the rule is written now, you are not allowed to make any substantial changes after the 13 October deadline. There is certainly tweaking and tuning that would be going on at that point. Since a lot of you have already asked that, again, we are pointing out these rules are flexible, and it is something we could consider. I would consider it highly likely, we will give you an opportunity to submit modifications. We will put details about that up on the

website.

QUESTIONER: What are the rules concerning the damage to our vehicle caused by another vehicle? Do you have an idea how you are going to handle that?

PANEL: Okay. Somebody else asked me the question. I don't know if you all heard the question, so I will repeat it. What are the rules concerning damage to Team A's vehicle by Team B? All right. Right now, the way the rule is, Team B, number one, is out unless it was minor and unavoidable and, in the opinion of the field judge, it did not affect the competitiveness of Team A. Are you all following that? Sorry I am going so fast on that one. But the big question is what about the aggrieved -- is that what you call the vehicle that got hit? -- the aggrieved vehicle, okay. What is in it for them? There isn't a rule on that right now, and I have already made a note to myself that this needs to be investigated. So we are going to have to get back to you on that, but the hitter is out. I don't know what we do about the hit-ee yet. Sorry. Okay. Next question. Remember, these are critical questions. So please ask them. I am not saying we have all the answers, but by the 1st of April, we are certainly going to have a group huddle and we will answer

all of these questions to the best of our ability by the 1st of April so that you can move ahead. So please ask the hard questions.

QUESTIONER: David Peck. I think my question on proprietary information has been answered so far, but I will probably have more. But I will ask anticipating that nobody is going to win this first race and we resubmit our entries in subsequent years, what is going to be the procedure -- that we start over after each race or submit technical papers with modifications?

PANEL: We haven't developed the rules for DARPA Challenge Two yet, obviously, but it would probably be a similar process, assuming it is going to go as planned. If you are submitting the same design that you had already submitted in a previous year, I would imagine it would be accepted pretty straightforward.

QUESTIONER: Okay. Any proprietary information that is disclosed after this first challenge will be protected in anticipating we will resubmit the entry.

PANEL: We will work with you to make sure the proprietary information is agreeable to both parties. Okay? That is something we have got to go back and work, what

constitutes that, how much can we give and play. So let me take that on. That is a good question. The insurance is a good question. Those two questions, I will go out and tackle. Next question, please.

QUESTIONER: My name is Brad Filkins [ph] from San Jose, and I was wondering what is the maximum depth on the water crossing that we are going to be expected to make, and is it mandatory or can we avoid it?

PANEL: The maximum depth will be up to Mother Nature because it could rain that morning or the evening before, and I believe that when we do actually give you the waypoints and what have you for the course, there might be a way that you could make the decision to go around it or straight through it. I think that will be part of the challenge that the survey team will build into the course itself. Next question.

QUESTIONER: I am Doug Blodgitt [ph] from Redondo Beach. I think you have alluded to it, but let me ask it specifically. Are there going to be any manmade markings for the boundaries or the waypoints?

PANEL: Not any we are going to tell you about. They will just be there for the judges, so that the judges

can tell whether the challenge vehicle complied with the waypoints that were designated. Certainly, we can't put chalk marks around a thousand waypoints, number one, because EPA probably doesn't want any chalk out there, and, number two, it is too hard. So whether we are going to sprinkle granola around it or something, we haven't figured out yet, but, yeah, they will be marked. But we are not going to tell you what the marking is. Only the judges are going to know.

QUESTIONER: Okay. So I guess, then, that the format of the waypoints is going to be the only information -- the format of the data given to us for the waypoints is going to be the only information.

PANEL: You are correct, but don't forget that the location of the checkpoint is going to be made known to all of the participants in time that you can make arrangements to get a hotel or pitch a tent or something and be ready to receive your vehicle. Next question, please.

QUESTIONER: Yeah. Bill McHarg [ph] from San Diego. I have a question on the E-stop. I understand an incoming signal to the challenge vehicle for emergency stop -- I would like to know if it is acceptable to have two types of emergency stop. One is stop at all costs, you know,

everything is going downhill there, and the other one would be if the judge or, for some reason -- I mean, they both would be considered stops and they have to follow the rules according to whether you are allowed to stop, but another one would say let the computer on board try to do it gently and stop in anticipation of going again.

PANEL: Mike, do you want to take this one? First of all, I would like to point out that -- let's just call it a hard E-stop right now. That doesn't mean you just close your eyes and slam the brake as hard as you can. We are anticipating if you are going at a significant speed, you may also want to keep steering as you are slamming on the brakes. I would assume when you are designing the system, you are going to anticipate that you are going to have to do an E-stop at some point on this course. So you don't want it necessarily to completely shut off all your system and then have to reboot and take a lot of time. So I would anticipate you would want to -- I am not exactly sure what you mean by a soft E-stop, but you always want to do it. I mean, I think stopping as fast as you can is not that great of a risk that you can't do that every time that you need to engage it.

QUESTIONER: The interpretation of the word

"emergency," if it is emergency, we have no idea what the computer is doing onboard. I would like to have an independent system on the thing that can go right to the actuators, bring the wheels straight forward, apply the antilock brakes or something like that, and kill the throttle, without relying on the computers knowing what is going on. That would be a real emergency. It is like stop at all costs.

PANEL: Are you talking about manually, a human telling the robot to do this, what you are calling a soft stop?

QUESTIONER: Yes. You would have two buttons in the chase vehicle. One is the big, red mushroom button, and the other one is a little yellow button that says come to a controlled stop as soon as you can, you know --

PANEL: The E-stop will only be engaged in an emergency situation. That is the point. I don't want a situation where you think it is going a little too fast for this turn.

QUESTIONER: No, no. I said following the same rules.

PANEL: So the only time it would ever be used is

when there is an emergency. So I would imagine we would want it to brake as quickly as possible every time it is engaged. Okay. Next question, please.

QUESTIONER: I also had a question related to the stop, but the manual stop. No one seems concerned about being able to activate a manual E-stop at 100 miles an hour, but, yet, we are required to have one. So the question is if the manual E-stop is triggered accidentally because I hit something, does that count against my time?

PANEL: First of all, the purpose of the manual E-stop, the primary way of stopping a moving vehicle, of course, is with some sort of wireless. So the way you would normally stop the vehicle is with the wireless E-stop. The manual one is there, meant as totally a fail-safe. I will give you an example of when you would use it. Suppose the robot is disabled and you want to push it out of the way. The first thing I would do is I would walk up to the robot, I would hit that manual E-stop, just to make sure. It is just a backup to make sure that thing is really not going to suddenly lurch and run over my foot or something. So that is really the purpose.

QUESTIONER: So it doesn't have to be activated

while the vehicle is in motion.

PANEL: Well, it should be designed that if it is rolling towards the crowed or something, but I can't imagine how at 100 miles an hour you are going to push a button or whatever.

QUESTIONER: And neither could I.

PANEL: And I would encourage you to design your button in a way that a twig or a branch or something doesn't accidentally push it.

QUESTIONER: Well, that is the tradeoff between being easily accessible and avoiding accidental --

PANEL: My understanding, I have seen a lot of these robots and they have thought this out. I am just going to make a suggestion. I am not the rules guy. I hear what you are talking about. We have this situation all the time. We have manual E-stop on PerceptOR vehicles and on UGCV. You need to make sure that you put that -- I don't want to make a rules suggestion. My suggestion to the Rules Committee is they allow you to design the mushroom so that it can't be accidentally hit. What I think we should be doing is making absolutely sure that 100 percent of the time, the wireless system works because that is the only one you are

going to be able to count on if the vehicle is moving towards somebody or it is moving to damage itself. So that is just a suggestion to our group that the manual E-stop is one that ought to be there for safety when you happen to be operating with people around it and it is not moving, but as far as safety is concerned, once the vehicle is moving, the only one we should be counting on is a wireless one. Thanks, Scott. Next question, please.

QUESTIONER: Hello. My name is Franklin Berger [ph], and I am a free-lance photojournalist from West Hills. My question was actually voiced by my colleague, Dan Fitzgerald, who didn't want to wait in this long line, but Dan's question is, do any participants, including the million-dollar winner, forfeit the rights of their technology to the Government? And I am surprised no one asked this sooner. [Laughter.]

PANEL: Forfeit the rights? No. The current rules say that the papers that are published will be made public. Now, we don't take possession of the vehicle is my understanding currently, the way that we are thinking. So the vehicle remains with the team to do whatever they like to do with it, but the technical paper that you submit will be

published in some forum that would be considered public. So you have to consider that as you are writing your technical paper and what you choose to include in it, with that understanding. Does that answer your question?

QUESTIONER: Well, was that a yes or a no? [Laughter.]

PANEL: That is a no. Okay. Next question, please. I got the PA guy and the legal person talking to each other.

QUESTIONER: David McMillan [ph] from Silicon Valley. Is the intent that the paper is going to be released after the million-dollar prize is paid or after each year's race?

PANEL: Right now, it is after the race itself. So, even if there is no winner, the paper is still going to be published.

QUESTIONER: Regarding insurance, is DARPA going to require or even permit the field judge to sign a general liability waiver as is customary in a racing event?

PANEL: Truthfully, we haven't decided how we are going to handle the field judge in relation to insurance. We will let you know about that by April 1st.

QUESTIONER: Okay. One other question, if a team expects to use an air safety vehicle and the weather is such that VFR flight is prohibited, what is the plan?

PANEL: You should have a backup. That kind of tells me where you need to be putting a lot of effort into. Next?

QUESTIONER: Hi. Darryl Fox [ph] from SOUNDS-A [ph]. Can we make custom annotations or alterations to topo-maps? So, if our robot is using a commercially available topo-maps, can we add custom markings or avoidance areas [inaudible]?

PANEL: Right now, there is no -- okay. Let me repeat the question because I can barely hear you. I want to make sure everybody else can hear the question as well. You are asking whether you can take commercially available maps and modify those maps for your own use for the purpose of participating. Is that correct?

QUESTIONER: That is correct. I was under the impression that we could use commercially available maps.

PANEL: Are there commercially available maps of the area in which the challenge will take place, is that the question?

QUESTIONER: No. Can we, before the race, add custom areas for avoidance or --

PANEL: All right. As long as you -- let me rephrase the question. I have also got bad ears here. I understand the question to be can you take a commercially available map and modify it for the purpose of competing, and the answer is yes, except that you cannot use classified information to put on that map. Did that answer your question?

QUESTIONER: Yes, it did. Thank you.

PANEL: Okay. Next question, please.

QUESTIONER: Dave Weber, Lancaster, California. My primary question was answered, but the secondary question is on the waypoints. I understand that the plan is to have them completed sequentially. However, if a vehicle misses a waypoint and recognizes that it has missed a waypoint, is it able to backtrack and cover that waypoint and continue on or does it have to re-sequence the waypoints?

PANEL: Mike? I think the general idea is yes, that you need to go in sequence and for the reasons cited, safety, compliance with land use, et cetera. So, yes, I think the idea is that you do need to do them in sequence.

Some areas where safety is going to be a real problem, you may even see waypoints that are very, very close together just to help you out, keeping in mind that following waypoints alone isn't going to be sufficient. Next question, please.

QUESTIONER: David Gawkins [ph], Robotics Society of America. Two questions. First, are there any provisions for radio frequency assignment for the E-stop, since many people will probably be using similar channels? It might happen that one team has to E-stop their vehicle and that radio signal may be on the same freq as another team's E-stop. Are there any provisions for assigning channels or some such?

PANEL: You will not be assigned channels up front. What you are going to do is when you submit the technical paper, you are going to describe what system you are using. For example, if you are using a commercial system, that will be real straightforward. If you are doing something yourself, you can tell us what frequency you are going to be operating on and that kind of thing. We are then going to look at all the teams and what they have submitted to make sure there aren't any conflicts, and if there are conflicts,

DARPA will do the deconfliction and let you know. That is another incentive to get your paper in early. Frequencies will, more or less, be assigned on a first-come-first-served basis, as long as you reasonably can't claim to have the entire bandwidth for yourself.

QUESTIONER: Second question, what are the provisions for chase vehicle breakdown? If the chase vehicle gets a flat tire and the autonomous vehicle keeps going [inaudible].

PANEL: The challenge vehicle would have to be E-stopped until the tire was fixed.

QUESTIONER: Does the driver of the safety vehicle have to be SCORE-compliant? In other words, does he have to have particular training or wear special equipment?

PANEL: The individual needs to be someone pretty special. I would highly suggest anyone that is thinking of entering the contest to contact some of the SCORE drivers and have them be your safety vehicle driver. As far as him being tested or having to have a SCORE license, no, that is not required at this time.

QUESTIONER: On obstacles, will there be any moving obstacle intentionally placed on the route[inaudible]?

PANEL: Okay. No. Wow. When you say "intentional," certainly there will be other vehicles on the route. There are going to be other challenge vehicles. There are going to be other safety vehicles. Well, those are there intentionally, but if you are asking if DARPA is going to have those little pop-up deer that run across, we are not going to have those. [Laughter.]

QUESTIONER: Is there a maximum dimension for obstacles?

PANEL: Maximum dimension?

QUESTIONER: Yes.

PANEL: Mountains? Do you mean like height?

QUESTIONER: Yes.

PANEL: Well, we are not specifying a maximum, no.

QUESTIONER: Everything will be natural?

PANEL: No, I can't say that. I can tell you that we don't have any firm plans to build something out there like an erector set. It might be that we have to get a truckload of gravel and put it in front of something for safety reasons, that the vehicle would either avoid and if it doesn't avoid it crashes into the gravel and stops. You know, we are leaving it open. There are a lot of natural

obstacles out there, but it is not going to be like miniature golf or anything. Let me take that on. The bottom line is that we probably won't need to build anything. Mother Nature has provided plenty of obstacles. Just moving your vehicle from Point A to Point B is going to be challenging enough. The speed and distance is a challenge. So, right now, the answer is we will reserve the right, and you will find out on race day. Okay?

QUESTIONER: At the start, when -- I haven't seen this in any of the documentation yet, but at the start, how close and what will be the spacing of the vehicles?

PANEL: I would say that would be determined by the number of entries. There could be the potential that we would start every 30 seconds, one at a time, or every half an hour, or we might do a land rush start, four abreast, and go towards a point that you will have to narrow down and one is going to have to let off or three are going to have to let off and the others are going to get through. But at this point, it really is going to be how many entries we receive.

QUESTIONER: The reason why I ask if there is any active emissions from competing vehicles, if that causes some confusion or maybe erroneous operation of the vehicles, if

there is going to be a minimum spacing.

PANEL: All right. So you are asking if the vehicles end up so close laterally that they present problems for each other. Is that the question?

QUESTIONER: Yes.

PANEL: Well, you can get real close. I mean, you can't beat the record, but you can tie it, for getting close. [Laughter.] Let me just point out, we are not sure how many vehicles we are going to have enter. We are not sure what the starting departure point is going to look like. If it turns out we have a mile-wide start line and two vehicles, the situation you just brought up is not going to happen. If it turns out we have a very narrow start line and a lot of vehicles, we will think of something else. We are going to take those considerations in mind. I don't expect that to be a problem. In terms of developing your sensing capabilities, it will probably be beneficial to have some sort of sensing laterally.

QUESTIONER: Brian Reed [ph]. I had a question about collision of vehicles. Are there going to be any transponders or anything on vehicles to help collision avoidance? How can you tell like a stopped vehicle from a

boulder, per se?

PANEL: Mike, do you want to take that one? Okay. The question is: Is there any kind of a transponder that is going to be put on vehicles to help avoid collisions? Is that the question?

QUESTIONER: Yes. Yes, that is it.

PANEL: Okay. No. [Laughter.] Well, a transponder is a two-way radio, and your vehicle is not allowed to receive data. Next question, please.

QUESTIONER: There was a phrase in the presentation on rules about two-way signaling permitted within checkpoints, but at the same time remote control of the vehicle is not permitted. So I didn't understand what was meant by that.

PANEL: Autonomous two-way signaling. No tele-operation. No human-in-the-loop tele-operation.

QUESTIONER: But it said two-way signaling is permitted. What did that mean?

PANEL: That means you can do handshakes and beaconing between your gas pump and your bot as long as no human is doing the tele-operation.

QUESTIONER: Okay. On the issue of obstacles, I

think wire is kind of a special class of obstacle that typically needs special sensors. It might be useful if you could tell us whether or not to anticipate wire obstacles.

PANEL: Currently, there are gates that you are going to be going through, cattle guards, and adjacent to the fence or -- excuse me -- adjacent to the gate will be wire on either side of it. So there is wire on the course. There is good old cowboy barbed wire.

QUESTIONER: That is a major safety issue. If I miss a fence and I run into that, there is a chance that I could injure everybody in the vehicle by hitting a barbed-wire fence at 50 miles an hour.

PANEL: Let me just say this. I hear your question. First of all, we have said something in the rules there that we are going to traverse the intended course with a 4-by-4 pickup truck. So we are taking every measure to run the course. We are taking every measure to clear folks from the course. We are doing everything we can to make it as safe as possible. So, from our perspective, the course layout will be safe to run on that particular day. Do you have anything to add to that, Sal? No. That really is the bottom line. I think that is it. Okay. Next question,

please.

QUESTIONER: Hi. My name is Triston Crees [ph]. I am from ISE In Vancouver, Canada. I had three questions, but one has been answered. The other one, the E-stop, no one has really mentioned what the maximum stopping distance is. I can activate an E-stop and my vehicle could brake immediately, but say in this environment, it can be hundreds of meters before it actually stops. A vehicle that is doing, say, 50 miles an hour, how much distance do we have to stop in?

PANEL: There is not a quantitative restriction. You are required to make the robot stop as fast as it can.

QUESTIONER: Because that does imply that you might activate the E-stop immediately on becoming aware of the situation and still wipe out the crowd.

PANEL: Hopefully, that won't happen. We certainly are going to design the course to where you are not heading straight for a crowd at 100 miles an hour and then have to make a sudden left turn and if you don't make it, then we engage the E-stop. We will certainly take that into consideration.

QUESTIONER: So, at this point, there is no maximum

requirement on the E-stop?

PANEL: There is just from a reasonable standpoint. If it takes you 2 miles to stop, it is not going to be acceptable. It should be the equivalent, I mean, I know you may not have wheels, but it will be the equivalent of slamming on your brakes in the car. It has to be something along those lines.

QUESTIONER: Okay. My second question is more curiosity. If this does go to multiple years, will it continue to be L.A. to Las Vegas or could it be in other types of geographical terrain?

PANEL: Mike, the question is multiple years and the route. I just point out the actual course, the series of waypoints will certainly change year to year, in case that is not obvious.

QUESTIONER: No. I mean, is there potential for snow and ice?

PANEL: That has not been decided yet. That question is still open. A lot of discussions within the committee to come back to the area, a lot of discussion, 50 percent of it, says lets go do another route. So that is open. The bottom line is if no one wins, we are going to

follow it up with another Grand Challenge, and that is the critical point. Next question.

QUESTIONER: All right. Thomas Eaton [ph]. This is regarding when the challenge vehicle is on the surface streets. Sal, you had mentioned something about traffic signals. Are the challenge vehicles required to obey the basic road rules when they are on the surface streets or can they ignore them?

PANEL: I hate to use the word "ignore," but our plan is whenever we are on an existing street, that street will be closed down for a period of time while the entry is on the street, and that means the traffic lights or side streets, so that you will not be concerned about oncoming traffic or side traffic or passing a truck or anything like that.

QUESTIONER: So the challenge vehicle can just go through stop signs, red lights, et cetera?

PANEL: Correct. Hopefully, the stop signs will be green -- or the traffic lights will be green, but if there is a situation, obviously, that we cannot do that -- and I don't think that is going to happen -- that will somehow be built into the program that they are going to give you 2 hours

before that you will have to come to a stop. Next question.

QUESTIONER: I have two questions. Can we send a signal to the robot to notify it about the time that won't be counted against us for E-stops as directed by the judge?

PANEL: Can you repeat your question?

QUESTIONER: Can we send a signal to the robot to notify it about the time that will be not counted against us for E-stops as directed by the judge? Just basically -- because the judge is telling us something that the robot needs to know if we are going to have -- with time frames.

PANEL: No.

QUESTIONER: Okay. Could SCORE or DARPA let us know where we could go to possibly do testing for the vehicle, similar courses, stuff like that, for the rest that aren't off-road people? Just something on the website or something like that.

PANEL: Yes, we can. We could be more than happy to, and we will have it on the website of different locations in Arizona, Nevada, California, and Baha. Okay. Thank you. Next question.

QUESTIONER: My name is Muzi Oran [ph], Lopel Beat [ph], Israel. I have two broad questions. One is we do

have a fully owned U.S. subsidiary. Can we use that as the main vehicle or main thing?

PANEL: Is your subsidiary incorporated in the United States?

QUESTIONER: Oh, yes.

PANEL: Okay. Yes. Then it will be considered an American company.

QUESTIONER: Okay. I don't need another corporation?

PANEL: No.

QUESTIONER: Good. [Laughter.]

PANEL: You can if you want, but no.

QUESTIONER: In this same vein, we do not use any U.S. Federal funding, but we do use Israeli Government funding for our program. [Laughter.]

PANEL: Negative. Next question. Really, no.

QUESTIONER: It is very minimal funding, but still -- [Laughter.]

PANEL: We will take that under advisement, but I don't think so. We are going to think about that one. Let's lean towards a no.

QUESTIONER: Secondary question is the commercial

availability of some trails. There was a question about maps. How about aerial photography? If we use a local, commercially available aerial photography service ahead of time, is that okay?

PANEL: Yes. The question was can you use commercial imagery, aerial imagery, and the answer is yes.

QUESTIONER: What I mean is photography that we order, we ourselves do it with a commercial company, a local commercial company.

PANEL: Yes. If it is available to the public and anybody can order that imagery just the same as anybody can order a map or anything, yes. The answer is yes. Next question.

QUESTIONER: Hello. My name is Anthony Levindowski [ph] from UC-Berkeley. My first question is: Is it DARPA's intention to run the course in areas where regular GPS signals are not available?

PANEL: Let me just say the preliminary runs on the various tracks, we have received GPS. So that is not an issue for me at this time. Will we come across that as we further investigate the various routes? Possibly, but we will let you know.

QUESTIONER: My second question is you said that the vehicles cannot receive any data. How do you consider -- I mean, GPS is satellite time information.

PANEL: Right.

QUESTIONER: The other question related to that is: Are you allowed to have a satellite communication or communication with other robots without involving humans?

PANEL: The answer to the first question about whether a robot can receive GPS data or any freely available public radio-positioning service, GPS is an exemption, any radio-positioning system is an exemption for the kind of data that the challenge vehicle can receive. Your second question, I think, is: Is your challenge vehicle allowed to collaborate with other challenge vehicles? Was that the second question?

QUESTIONER: Well, what if I set up as public system on my vehicle to broadcast out positioning information? Can I use another challenge vehicle to receive that information?

PANEL: No. It is because it is not freely available to the public. The question is you are going to have two challenge vehicles, and you want to transmit

information from one to the other. Is that what I heard?

QUESTIONER: Well, from one to anybody that wants to listen in to it.

PANEL: Negative. Negative. Thanks. Let's move on. Appreciate the question. Good try, but it is a negative. As a follow-up to that, I would also point out, there is no team work at all between -- you know, you are free to field two vehicles, but they cannot cooperate in any way, not just they can't send signals. You can't have one push the other one out of the hole if they get stuck or something like that. There is no cooperation. Next question, right up front.

QUESTIONER: My name is Philip Tau [ph]. I am from Los Angeles. My question is regarding the boundaries of the race course. It is my understanding, you are going to supply waypoint information in the forms of latitude and longitude along the race, but if we have two waypoints and say a cliff in between, how far can we sort of go laterally and around the cliff before we are disqualified? Is there information in the actual text for boundaries of the race course? Are you going to provide that along with the waypoint information?

PANEL: Yes. That information will be provided in the dataset that you get 2 hours before the race, and I showed a slide up here of just a notional format. I am soliciting input for how people would like to see that – as it was displayed or how they would like to have them presented and also what kind of media, if you could just e-mail in to grandchallenge@darpa.mil and let us know. Next question in the back.

QUESTIONER: Ted Hoodako [ph] from San Francisco. This might actually be an elaboration on the previous question from back here. What is your expectation for GPS or rather differential GPS and specifically WAAS coverage over the entire course? Also, what is the circular area error radius for the vehicles passing checkpoints? The reason I am asking the question is that the U.S. Coast Guard website indicates that significant areas of the Mojave are not covered by WAAS.

PANEL: The first question, is GPS going to be assumed over the entire course, the answer is no. There are many types of systems. We are not going to tell anybody that they have to use GPS. We are going to give coordinates in WGS-84 reference spheroid. Whether you use a GPS, an INS, or

a star tracker to figure out where you are, it is totally up to you. Keep in mind that the error that you just described with or without WAAS is something that we are working on right now. I mentioned earlier that I don't know yet what the radius of the permitted circle around the waypoint is going to be. We are working on that, and we will present that information as soon as we can.

QUESTIONER: Can you at least guess within order of magnitude? Is it 1 meter, 10 meters? Is it 100?

PANEL: I would say in the neighborhood of 10 meters. Okay. Next question in the front.

QUESTIONER: Ken Diffanee from Edwards Air Force Base. A question regarding the technical design. I spent time writing the paper already, and since it is such a short design cycle, is there a way that we can list what you consider are going to be mandatory on the technical design and then say this would be nice if we have time to complete it, include that in with the proposal? That way, if we show up to the door, we are going to have a minimum amount of equipment to do the race, but if we have these extra sensors, it would help the vehicle be a little bit better, then that would be fine. Obviously, if it is not in the optional list,

then we are breaking the rules. I am just trying to get a little bit more -- so we are not trying to resubmit every time an addendum to add a new sensor or, you know, to go through that process.

PANEL: If you're talking about new software or something like that. You can try it out and see if it works, and you can propose that. It most likely would be accepted as long as it is not something outrageous. Things like sensors are pretty much always going to be accepted, as long as there is no way to use it and to cheat in any way. The one thing I do need is a final version of what you are going to have, so that we can expect it and compare it to what that is.

QUESTIONER: Okay. And I have one more question. This regards more to the safety not with the barbed wire. That is another issue. It is with a 3-second dead-man stop. I fly both Global Hawk and UCAV, and Global Hawk has a 6-second timer. I stayed up until 2:00 last night reading the new rules. They were a lot different than the website.

You guys have proposed a 3-second dead-man stop. If your vehicle comes over the top of the hill, drops over the top of the side and then just starts slamming on the

brakes and we are trying to catch up to it, it is going to look like a L.A. Freeway on a foggy day in Salinas, California. You are going to have vehicles just running on top of each other, especially if we are trying to achieve 50 miles an hour.

PANEL: I am aware of this concern, and regarding what you are talking about is the delay between the activation of the emergency stop and when the vehicle itself executes that command. Is that what you are talking about?

QUESTIONER: Yes, that is right. I am not saying that it has to be 3 seconds and I am not saying it should be 50 because that is unrealistic, but it needs to be something in between that, a little bit better than 3 seconds. I would say somewhere between 5 and 10 would be realistic.

PANEL: We totally agree that we need to investigate this. It is a good point, and I promise you, we will. Next question in the back, please.

QUESTIONER: Michael Johnson with the Ultimax [ph] Group. This is a couple of questions about insurance. First of all, with the --

PANEL: A couple insurance questions?

QUESTIONER: Yeah. With the rules, when do you

expect the rules to stabilize given that there may be changes? Certainly sometime before April 1 would be helpful.

PANEL: Well, April 1 is only a month away. So we are taking all of your questions under advisement and any more that come in. I don't think that is an unreasonable length of time, but we can't guarantee that they will stabilize before then.

QUESTIONER: Okay. A little commentary before the second question. Currently, the California Vehicle Code says it is illegal to drive a driverless vehicle on roads, and insurers don't provide insurance for illegal activity. So that is an interesting problem. The fact that we have the possibility within the new rule change, there is a possibility of non-participants being on the route. That creates a tougher design standard to make the vehicles courtroom-proof rather than battlefield-proof. So the question is: When will the insurance requirements for this event be made reasonable?

PANEL: First of all, about the California law, we are not going to be running these vehicles on public roads while the public roads are open. We are going to get a permit to hold a special event. For example, during the Rose

Bowl Parade, the floats may not be licensed and registered vehicles, but you get a permit to close down that public street and to do what you want. The same thing would happen in Sal's races. His race vehicles aren't publicly licensed vehicles to run the road, but if you close the road, it is okay. I am not sure, your question about allowing other people on the course, that is not our intention. The public roads certainly will be closed. The trails will, to the best of our ability, be cleared. We are not going to allow anyone on the course, but we can't guarantee with 100-percent certainty that we won't have any stray civilians coming into the area.

QUESTIONER: Certainly, you can see the concern we have. Somebody gets hurt. They go to sue, and they are going to say, "Hey, you were doing illegal activity." Insurance companies are in the business not to pay out. They are only in the business to take.

PANEL: There is no illegal activity here. We are going to get permits to use the roads for this purpose. So there is nothing that is going to be illegal here.

QUESTIONER: I understand that will be an argument that the prosecution will use. Right? Thank you.

[Laughter.]

PANEL: Once again, let me foot-stomp. We are working with the local, state, and national level. So we are going to comply with all of the rules. Wherever we need to, to get a special permit, we will go after those special permits. So we are going to make this event as safe as possible. Insurance is a major question, and we have got to address that before the 1st of April. Next question, please.

QUESTIONER: I had one on my card here, but I need to follow up your answer to the distinguished gentleman from Israel. I believe you told him that he could hire a commercial surveying company to survey the course between the 2 hours that the waypoints are released and the start time of the course.

PANEL: No, no, no. Before that. Months before that.

QUESTIONER: Months, 2 hours. What is the difference? Where is the deadline? At what point can we no longer survey the course?

PANEL: You won't know what the course is until 2 hours beforehand, but if you wanted --

QUESTIONER: That is plenty of time for me to take

aerial photos of a 250-mile stretch.

PANEL: Then, fine.

QUESTIONER: That's fine? I'm sorry? Is that -- that's okay?

PANEL: Right now, you will not know the course route until 2 hours prior. What you do in that 2 hours, I am going to leave it up to you to decide. Next.

QUESTIONER: Hi. I am Dave Thomas with Gadget Man, L.L.C., out of Colorado, and I only have one question here. This deals with the waypoints. If you have been out in the desert on the little trails and stuff, the little small roads, there are little forks branching off everywhere. Are the waypoints going to be set up to try and keep us from like taking a wrong turn, or will it have to have the intelligence of "Gee, I am going away from where I should. It is time to turn around and go back"? Will it have to choose a number of forks in the road to get from one waypoint to the next?

PANEL: There is no guarantee that by -- okay. Let me just repeat the question to make sure I got it right. The question is: Are the waypoints going to be set up in sequence in such a way that if you pass through every waypoint, you will not go off the course? Is that it?

QUESTIONER: Yeah, pretty much. If it is between two waypoints, there is a fork in the road, and you have a choice of either going the wrong way or the right way, like will it be set up so that that mistake is possible, I guess, is really the question.

PANEL: Well, if you take the wrong fork, you won't make it to the other waypoint, right?

QUESTIONER: Well, yeah. So -- okay. I guess that pretty much answers the question. [Laughter.]

PANEL: Yes, it does. All right. Let's move on. Next question.

QUESTIONER: Hey, I am Zack Chambers from Rose Holman [ph] in Terre Haute, Indiana. One short, easy question. Will the slides from today be posted on the website, particularly the ones from Sal's presentation?

PANEL: Let me address that. The bottom line is that all of the presentations seen today will be posted on the website. Okay? We will make sure that we have got an updated roster. I did promise that we will pass out the roster. I was informed by my staff that the roster that you will get this afternoon is everybody who has registered by the 21st of February, and so I know we have got a lot of

newcomers that came in. So your name will not appear on that roster. However, when we get the roster on the web page, it will have a complete list. Okay?

QUESTIONER: Chris Manson, Los Angeles. Will there be logistical support to get dead vehicles off the course and get them back to a paved road or civilization in the most efficient way possible, or will the chase vehicle have to be responsible for trailering it or be able to remove that vehicle from the course?

PANEL: There will be no Government logistical support provided to move the challenge vehicles or the safety vehicles. There may be some Government logistical support, nothing promised, for such common items as port-o-potties, water, stuff like that, but the answer to the logistical question is no. Next question.

QUESTIONER: In order to use a commercially available map, we need to obviously put it into a form usable by a computer. Are there any restrictions placed on the formation of sophisticated software maps such as creating -- if there is a road on a map, you can make that into an object and have various properties that you program? And can we add information other than that which is on or implied by a

commercial map? Like could we go drive there and find a rock and say I don't want to hit that rock and put that rock onto our software map?

PANEL: The first part of that question, you are allowed to modify the maps, and by that, I mean you can look at the map and draw areas. Like we said before, don't go there [inaudible] equipment beforehand. Don't even think about going in this area. In terms of rocks, I don't think rocks would ever show up on any -- I am not sure what size rock you are talking about, but if we are talking this big, it is not going to be on the map in the first place.

QUESTIONER: I know it wouldn't be in a commercially available map, but if we found a rock, can we put that into our map?

PANEL: You mean you are proposing to go find all the rocks in between L.A. and Vegas beforehand?

QUESTIONER: Yes. [Laughter.] I could, for example, drive, drive around --

PANEL: Here is the issue, though. You are implying that you are going to have access for a pre-run.

QUESTIONER: No, no, no, no. Just drive. I can drive around in the desert and find rocks and map them. Is

that --

PANEL: Okay. You can do whatever you want to with a map. The answer to that question is yes, but you are not going to pre-run the course. Okay? Next question.

QUESTIONER: My name is Salem Pallesini [ph] from San Francisco, California. You specified that waypoints will be provided as latitude, longitude data. What would happen if one of these waypoints is set within a GPS dark spot because of geography or whatever, and would this be a legal possible waypoint?

PANEL: Just a moment here. I am going to make sure we have the right answer. [Pause.] The question is: Is it possible that there might be a waypoint that we designate that, at the moment you arrive in the vicinity of the waypoint, you cannot receive GPS? Is that the question?

QUESTIONER: Let's say you set up a waypoint in a canyon, in a riverbed in the bottom of a ditch that a normal GPS with normal antenna will not be able to get reception down there. So the waypoint is there and the location exists physically, but it is impossible to make sure that you are on it.

PANEL: Right. I understand. You should not

assume GPS reception at any of the waypoints. I mean, we certainly can't guarantee that. It is imagined that many, if not all, of the participants will rely on GPS, but we certainly can't guarantee that each waypoint is going to have good GPS coverage. Certainly, if a waypoint, you can imagine, is designated under an underpass, that you would not be able to get that.

QUESTIONER: Okay. Second question is -- this is following up to somebody else's question that it would be very difficult to distinguish from a broken-down robot and a boulder or something like that. So, in the bottleneck situation in which the broken-down challenge vehicle is blocking the whole course within the boundaries, how is this to be handled? Because suddenly you cannot tell it is a robot, and suddenly your course within boundaries has a 5-feet-tall obstacle that it is impassible. So are you supposed to get off boundaries and risk penalization just to go around it? Are there going to be beacons? Somebody said transponders, and that was his catch. Are there going to be beacons on the robots that would distinguish them from an inanimate object?

PANEL: Okay. I think we have got the question.

Do you want to try that one? Okay. Let me go to the beacons for a second because I have gotten a question that was sent up here asking about having beacons. We have an idea that we haven't firmed up yet, but those of you who have read the rules see that there is a requirement to provide 12 to 14 volts on top of the -- or somewhere on the vehicle. The idea is we may, if everybody agrees, want to put a small beacon up there to broadcast the position of the bot, so that it could be web-cast. Okay? That has got nothing to do with any beacon used for collision avoidance or anything like that. We also have no intention of putting any beacons on any rocks or boulders. Your question did -- part of your question related to coming up on a disabled vehicle in the middle of a narrow trail. Is that correct?

QUESTIONER: Yes.

PANEL: Okay. If that happens and the vehicle hasn't moved in 10 minutes, the vehicle is disqualified. It is not in the Grand Challenge anymore. It is over. You can touch it. You can move it. You can move it outside the boundary because you are permitted. When we get these land use authorities, if it is a narrow boundary, the boundary exists for the purpose of Grand Challenge. That vehicle

isn't in the Grand Challenge anymore.

QUESTIONER: The question was more like to the point of if it is a robot that is stopped because it is re-plotting its map or something and it will take 4 minutes --

PANEL: I think we have answered that, and the bottom line is if the robot is in front of you, that robot has got 10 minutes to move. If it doesn't move in 10 minutes, that safety team will move the robot, and the following robot will pass. Okay? Thanks. Next question, please.

QUESTIONER: Well, both of those questions kind of segue into mine. The first one is: What is the penalty for missing a waypoint?

PANEL: Mike? It hasn't been established yet. The penalties, we are still working on the nature of the penalties. As you go through the rules, you say it is mandatory. You do this and that and the other thing. The next step is to develop a table and to decide what an appropriate penalty is. So, if you miss a waypoint, I don't know yet. We don't have that. It may depend on the field judge saying, "Look, the waypoint is a mile over here and you didn't hit it." Perhaps that would be a disqualification.

QUESTIONER: Well, in downhill skiing, you are assessed a time penalty for missing a gate or something. So I had that analogy.

PANEL: The penalties, I would imagine would be time penalties for certain undesirable behavior. For the most egregious behavior, it would be disqualification, such as ramming into another vehicle and knocking it out of the race. Good question.

QUESTIONER: The second question is in considering collision avoidance and that kind of thing, if I may extend it to courtesy on the track, why not apply California DMV rules to the vehicles? The guy on the right has the right-of-way and that kind of thing.

PANEL: Where in California do they do that? [Laughter.]

QUESTIONER: In the rules.

PANEL: You had rules, huh? Okay. Next question. Thank you.

QUESTIONER: Well, actually what simplified making up the rules to the collision avoidance logic.

PANEL: No, I hear you. We will take that on and look at it. Next question, please.

QUESTIONER: David Gawkins. Regarding the starting position, if, for example, there are 40 vehicles that are entering the contest, how are they going to start? Are you going to have staggered starting in terms of the time or is there going to be pole position?

PANEL: Let me answer that. Right now, that is still under advisement. We are going to work that. We do not know how many entrants we are going to have, but if 40 vehicles enter, our concern is if you do the land rush and then you start narrowing down to the waypoint designation -- I want the vehicle to complete the race, not to be bumping with each other along the route. So that is something we are going to have to take under advisement and work the details for. So there are two options: land rush or separate them by a time, as Sal mentioned earlier. We are going to work both of those. Next question.

QUESTIONER: Watson Straining [ph] from Berkeley. I have two questions on sensors. The first one is if we are using radar on the robot, are there frequency bands that have been allocated, and also the power limits, what is going to be the policy on that?

PANEL: Mike? You are referring to the E-stop. Is

that right?

QUESTIONER: No. Sensors.

PANEL: Oh, radar.

QUESTIONER: Right. So we are concerned about interference with other radars.

PANEL: Right now, of course, you have to comply with any FCC regulation, but other than that, we are not giving you -- allocating you bandwidth or anything like that. So it may be something for you to consider. Let me take that on. The answer is no, we haven't looked at it carefully. We will take that on.

QUESTIONER: Okay. I have a second question. If the vehicle has a pod that can go up, you know, it is an integral part of the vehicle, it will go up [inaudible], come back and then the data would be captured and the vehicle will do the necessary navigation, is that allowed?

PANEL: Are you talking about tethered or untethered?

QUESTIONER: It is untethered. I can go up and --

PANEL: Definitely, untethered, no. Just for safety reasons, really. We are having enough trouble keeping track of one vehicle. We don't want two, especially when one

is flying all over the place. Next question in the back.

QUESTIONER: Eric Chateau [ph] from UC-Davis. Will you set restrictions on wireless telemetry between the electric vehicle -- I mean the entry vehicle and the safety vehicle for the purpose of monitoring and anticipating each situation that might require an E-stop?

PANEL: We would ask you to write that in your technical paper that that is your technical approach for doing that and let us take a look at it. The question, I think, was: Are you allowed to send telemetry from the challenge vehicle to the team for the purpose of evaluating the performance of the challenge vehicle? Is that correct?

QUESTIONER: Yes. That is correct.

PANEL: Okay. We would like you to request that in your paper and indicate in the paper how we could be confident that telemetry wasn't going to be used for any other purpose.

QUESTIONER: Okay. One follow-up. It is on the issue of recognition of another entry. I was thinking of a situation where you might have a small ATV-size vehicle that has been stopped and it might be in the 4 minutes -- no, of its 10-minute countdown, and you are coming up on the vehicle

and you can't distinguish it from a boulder and you decide, well, I can go over this obstacle and just run over it. [Laughter.]

PANEL: The judge -- if you come across -- you are approaching a disabled vehicle. The judge can issue a mandatory E-stop, which you will not be penalized the time for. It is a judgment call by the judge whether it is disabled or thinking. Next question up front.

QUESTIONER: I have a second question. This one has to do with the design of the E-stop. I am wondering if my design would be sent back to me for this. So, in an emergency, can the vehicle be controlled remotely during an E-stop, so that people don't have to get out and move the vehicle while other robots are coming? If you go over the hill and you can't see the robot, the E-stop happens. So, even if it means me being disqualified, can I write in my design that, hey, if I get disqualified, I am going to move this thing remotely so that I don't put my --

PANEL: Yeah, that's fine.

QUESTIONER: -- teammates in harm?

PANEL: Let us think about that. Once you are disqualified, you are disqualified. So you can touch the

vehicle. You can do whatever you need to do to move the vehicle.

QUESTIONER: Yes, but if I put that in my design paper would it be sent back to me as --

PANEL: Put it in your design paper, and we will take a look at it. I don't see a problem at this moment. Okay? Next question.

QUESTIONER: Egor Karen [ph], Texas [inaudible]. I was wondering if there was any type of particular inclement weather that would essentially stop the race. You guys around here seem to have earthquakes from what I hear. Since some of our robots may have some type of [inaudible] sensors, I would like to know when they need to know that it is natural occurrence or not. So this is why I'm asking my question.

PANEL: I am struggling with your question here. We are going to run the race, no matter what, okay? If that is what you are asking, if we are going to delay it because of an earthquake?

QUESTIONER: Well, are you guys thinking about some type of E-stop during the earthquake so that essentially

[Laughter.]

PANEL: Thanks. We will move on. Okay?

QUESTIONER: No, I have a second question.

PANEL: All right.

QUESTIONER: Within the 2 hours that you are allowing us to have before the race, are we allowed to take photos of the other competitors' robots or whatever we are competing with?

PANEL: I don't see why not. I mean, we are going to line them all up. They are going to be on display and getting ready to start, whether it is a land rush deal or a sequence. We are going to have the press out there. They are going to be taking photos.

QUESTIONER: And should we assume it is 2 hours before or a bit more?

PANEL: Well, I think we will take that under advisement, but I don't see a problem taking photos. I really don't. Whether it is 2 hours or 30 seconds prior. Next question.

QUESTIONER: Okay. It was mentioned earlier that the chase vehicle has to act truly as a chase vehicle; that is, stay behind the race vehicle. If a vehicle has to backtrack for whatever reason, what does the chase vehicle

do? If the race vehicle is taking a wrong turn and has to backtrack, potentially coming back into an area of high traffic --

PANEL: Okay. The question is there is a rule that says that the safety vehicle cannot lead the challenge vehicle. There is a little sentence, I think. I hope it survived and it is in this rule package, that there will be brief periods -- you know, it is the field judge's judgment. There will be brief periods in which the safety vehicle can be ahead, but remember, I said the purpose for that rule is just to prevent somebody having a solution that has the bot follow the safety vehicle down the whole route.

QUESTIONER: This is a follow-on to that. Will the lateral boundaries be set to preclude the possibility of having to backtrack in the tight areas, I guess, the narrow areas?

PANEL: Will the lateral boundaries be set to preclude backtracking?

QUESTIONER: Yeah. Preclude the race vehicle really having a logical possibility of having to backtrack. That is, if it goes outside a lateral boundary, obviously it is disqualified. I am wondering if there is going to be

enough lateral boundaries that that thing may start to climb a berm and decide that it wants to backtrack, which would cause large problems for everybody else.

PANEL: Right. The lateral boundaries are, for the most part, I believe, going to be set by the land use authorities. We are not setting them to make the route any more or less difficult. We would love to have just the widest open area, but we are going to have lateral boundaries. Now, if you are precluded from backing up because it is too narrow, you are going to have to work with that. You are permitted to back up. Okay? I mean, Dr. Fish knows more about this than me, but I have followed some of these vehicles around and the safety vehicle, the guy always has his hand on the reverse because these guys do back up. Next question, please, in the rear.

QUESTIONER: Dion Damato [ph] from Scottsdale, Arizona. I have two questions. The first one is: What is the minimum or maximum distance between the waypoints? You said that they are going to be closer in local areas where roads are, but what can we expect as far as -- are they a quarter mile, 50 miles?

PANEL: Mike? It is still to be determined, and it

is going to be varying widely. There will be some places where, because of land use issues, we may have to keep you on a very narrow, winding course. So we will have the waypoints very close together. There will be other areas where you are allowed to go over a very wide stretch. So we may have a mile in between waypoints. That wouldn't be completely outrageous, but the exact number is still to be determined. You are not going to find that out until right before the race.

QUESTIONER: Okay. The second question is: With the 2 hours before the race, is the course open for competitors to drive on?

PANEL: Negative.

QUESTIONER: Okay. There was an earlier question with taking -- flying over the course in that 2 hours.

PANEL: Negative.

QUESTIONER: You can't fly over the course in 2 hours.

PANEL: You can take pictures of the course by commercial entities, if that is what you plan to do. So, if that is a commercial entity and everybody has access to the course at that time, you think you can do it in 2 hours, that

is fine. I think that Mother Nature --

QUESTIONER: So you can have a commercial driver to drive the course for 2 hours?

PANEL: Negative. There is no pre-running of the course. Okay? Next question in the front, please.

QUESTIONER: My name is Bob Thorpe. Actually, that was my comment, too. Somebody earlier had made the suggestion of like doing a fly-over within those 2 hours. My suggestion is it is all closed down.

PANEL: Okay. Thank you. Next question.

QUESTIONER: Yes. My name is David Walker from the University of Texas. I just need clarification. You mentioned earlier that transponders are not allowed. Are calibrated, stationary, differential GPS beacons allowed?

PANEL: That falls under that rule that I had on my chart. If that is your technical approach, you need to put that into your technical paper and let us evaluate it. Is this a private DGPS that you are talking about?

QUESTIONER: Yes, a privately owned DGPS.

PANEL: That is not explicitly permitted in the rule -- [audio break].

PANEL: [In progress] -- inputs on that. I mean, I

can't get any more precise than that, but if you want it less and everybody wants it that way, that is fine. A question in front, please.

QUESTIONER: There is a potential gray area in the participation of graduate students who are doing closely related research under Government sponsorship. Is that considered a conflict? Can it be resolved by them doing it, quote, "on their own time," or is that a situation to be avoided entirely?

PANEL: If you have somebody that has that circumstance, you should probably get in touch with us and let us evaluate it and see how closely related and what it is they are doing and who they are doing it for, just so we can tell you for certain because everybody's situation is a little bit different. So I can't tell you for sure that that is no, you couldn't use grad students in that category, but let us look at it and see what they are doing. Question in the back, please.

QUESTIONER: This is coming back for seconds. It is my last one question. Doug Blodgitt from Redondo Beach. Just a follow-up on navigable obstructions and disabled entrants. It is up to the judge's -- the safety crew's

judgment of whether incidental contact is allowable. Would that be extended to considering an entrant a navigable obstacle?

PANEL: I would say incidental contact is already allowed. If you are talking about totally running over and crushing it, that is probably not going to be --

QUESTIONER: No, no. The question is we have an emergency, been asked to do an emergency stop. Would the judge be allowed to say, based on the entrant saying, we can drive over that safely? Would the judge --

PANEL: Drive over, no. If you are talking about if the judge issues an E-stop and you slam on the brakes and maybe you tap the vehicle, are you going to be disqualified, no. That would be an incidental contact. If you can get around it and you are just going to lightly tap it, that is fine. If you are going to drive right over it, there is no reason to do that. You have got to E-stop. You are not being penalized. That time is going to be credited to you. So you just have to wait until we move that thing out of the way.

QUESTIONER: So you don't anticipate the judges allowing incidental contact while going over a vehicle?

PANEL: I wouldn't define "running over a vehicle" as incidental contact.

QUESTIONER: Well, no. It is a very controlled navigation of an obstacle. [Laughter.]

PANEL: Thanks, but I am going to give you the hook here. Next question, please.

QUESTIONER: This question is for Sal. By the way, I am Ted Hoodako again. What is average speed of vehicles in SCORE's Annual Barstow to Vegas Race? Could you give us some sense of how fast they go in that?

PANEL: We have not had a Barstow to Vegas Race in about 15 years. First, I think I could answer what you are saying. I have already driven three proposed routes in an F-150, a Ford pickup truck that is basically stock except for a little modification to the shock absorbers and using B.F. Goodrich all-terrain tires. I was able to average about somewhere between 38 and 40 miles an hour. I did get stuck in a couple of areas behind some traffic. I would think that of the three courses, the fastest course that I was on, a SCORE race or in a trophy truck or a Class One type vehicle, could probably average somewhere between 55 and 60 miles an hour on the entire 200 and approximately 50 miles.

QUESTIONER: Okay. Sort of a follow-on. Since it sounds like the bots are being asked to perform it 50 or 60 percent of what a human can do, any possibility that the organizers would consider basing the winner on maximum distance or number of waypoints covered in 10 hours?

PANEL: No. Thanks. I have got clear directions, you know? That is pretty easy. Next question, please.

QUESTIONER: Question regarding the mandatory 20-minute stop at the checkpoint. Is it going to be adequate just to have that thing pull up to the prescribed stall and E-stop it, or do you have a recommended or dictated procedure for that?

PANEL: We do not yet have any recommended procedure. It is currently envisioned that when you receive your file of waypoints that each team will have a unique waypoint. After entering the checkpoint gate, that will be a waypoint, there will be a unique waypoint, then, that will designate the parking area for your challenge vehicle if you are not using autonomous servicing. Then it is envisioned that, yes -- certainly, okay, you can imagine there would be a speed limit coming in there, right? So you will not be going very fast. You will proceed to the waypoint given for

your challenge vehicle to park for the 20-minute period, and that is correct. It is envisioned you would execute the E-stop, and that would be what would bring the vehicle to a halt and then reestablish the link when the 20 minutes are up. It would proceed to the departure gate of the checkpoint area at a slow speed and then go out. Next question.

QUESTIONER: Steve Stewart from Los Angeles. I have a question that doesn't regard stopped or disabled vehicles, but slower vehicles.

PANEL: Let me just stop you real quick. There are about seven of you who are going to ask questions. We have got 5 minutes. I would like to get all seven of you, but I would like to do this very quickly. Okay? Question, please.

QUESTIONER: Not regarding stopped or disabled vehicles, but slower vehicles on the course, so not an E-stop, but say a vehicle is going 30 miles an hour and your vehicle is going 60 miles an hour on a narrow portion of the course, are we all penalized, everyone behind that vehicle is penalized because the lead vehicle is going 30 miles an hour?

PANEL: If you can't pass it because of the lateral boundary?

QUESTIONER: Right.

PANEL: If you have got a good idea on how to write a rule for that, e-mail us because right now, the way it is, seriously, it is tough. You have got to wait until you can get around it. I can't think of any other solution, and I encourage you to e-mail us and let us know if you have got a solution.

QUESTIONER: Staging may be the only way around it, I think, staging a start. And are the winnings taxable? [Laughter.]

PANEL: Consult your tax attorney.

QUESTIONER: They are Federal funds, though; is that right?

PANEL: Next. Good answer from the General Counsel. Next question in the back, please.

QUESTIONER: My name is John Burge [ph] from Santa Monica, and my question is: How does the Government intend to determine that no competitor has used classified information to modify a domain map? The question is: How does the Government intend to determine that no one has done that?

PANEL: That is part of the overall inspection process. There is a lot of ways that people could cheat in

order to --

QUESTIONER: Yeah, but you said you wouldn't read the code.

PANEL: Excuse me?

QUESTIONER: You said you wouldn't ask for the software.

PANEL: No, but -- I mean, first of all, you couldn't just show up with classified --

QUESTIONER: Well, you wouldn't know I had done it, would you?

PANEL: We are going to ask you --[Laughter.] Okay. We are going to ask you to certify that you have not, one, broken the rules or, two, used any classified materials. If you sign that and we find out that you have -- and there are ways we can find out that you have -- then that will be -- that is a criminal action. So I would encourage you not to do that because --

QUESTIONER: Oh, I wasn't thinking of doing it myself.

PANEL: Oh, I know. [Laughter.] All right. Next question up front, please. I have got to move along.

QUESTIONER: You are giving us a thousand

waypoints. That is a lot of data enter in 2 hours and a lot of room for error. I am hoping that it is going to be provided in some sort of electronic form and that we would get a sample file ahead of time, so we could make sure that we are able to read this thing.

PANEL: Yes and yes. Next question in the rear.

QUESTIONER: Anthony Levindowski from UC-Berkeley. Sorry for asking another question, but it seems clear to me that you will not allow a pre-run of the course.

PANEL: Correct.

QUESTIONER: Could you please clarify whether or not you can, within a 2-hour time frame that we have of the waypoints, survey aerially the region?

PANEL: Okay. I will get back to you by April 1st on that. Let me go back because there is a lot of discussion on that. I want to make sure we get this one right. So let me table that one, and I will take that on. Next question.

QUESTIONER: To be on the safe side, I want to find out whether one of the vehicles we are playing with is a dual-purpose one; in other words, can be driven by a person or by a computer, either/or.

PANEL: Okay.

QUESTIONER: And it is standard military vehicle --

PANEL: Right.

QUESTIONER: -- would that be okay?

PANEL: Yes. Are you talking about tele-operated by a human or sitting in the vehicle?

QUESTIONER: No, no. Sitting in the vehicle.

PANEL: That is fine as long as there is no human sitting on it during the race. I have got to move on. I have got three more. I have got to go. Thank you very much. Catch me after the break. We are going to get a break here, and you can ask it then. Next question in the rear.

QUESTIONER: This is with the waypoints. It just occurred to me that someone is going to be defining the course using a particular receiver or survey method. What if they make a mistake and say you have to go to this latitude/longitude and that turns out to be in the middle of a cliff or a lake or somewhere they didn't actually intend to go?

PANEL: I won't be standing here next time. Okay? We are not going to make that mistake, but it can happen and I understand that.

QUESTIONER: In related areas, the errors

associated with a receiver, you might in all good intent say I won't go here and this is the data for this point based on my receiver and all the competitors say I am at the same data point according to my receiver and it is geographically different.

PANEL: Right. We are totally aware of that. We are very attuned to the fact that the data that we have to give you has to be absolutely accurate, and the previous question about if you are going to get a test file that you can run to make sure it runs, we are going to make sure this is very, very accurate. You are very correct that there is going to be an error circle, and I mentioned earlier that remaining within the area of the error circle will not necessarily keep you within the lateral boundaries of the course. If there are some very critical waypoints that we have to present to you, we are going to take extraordinary measures to make sure that the error circle of those waypoints that we give you are just as good as we can get them. Okay, last two questions.

QUESTIONER: Will [inaudible], Ventura County. Is there a way to prevent everyone's e-mail address from being exposed indiscriminately on your web page?

PANEL: I think you signed a statement that you released that e-mail information. I can do it by exception.

QUESTIONER: Okay. Question. Why not elevation along with latitude and longitude for a waypoint?

PANEL: We hadn't planned to give that information. There is no plan for it. If your technical solution -- actually, we have had a lot of requests for additional information, specialized terrain data, this, that, and the other thing, and we have actually told the other folks who corresponded with us that what we showed up with here is pretty much what we intend to give: the latitude, the longitude, the lateral distance, the speed, et cetera. If there is a reason that you need -- I don't know. We are just going to have to think about the elevation data. We just hadn't planned on giving that out. We are not collecting it. Can I get the last person, please?

QUESTIONER: Bob Thorpe. I don't want to be a wet blanket, but I would like to suggest a speed limit, the idea being that --

PANEL: Bob, trust me, you don't want a speed limit.

QUESTIONER: If there is an 80-mile-an-hour Humvee

coming up on my tail and I am in my safety vehicle, I would hate to be the test dummy that finds out that their collision avoidance system does not work. Long story short, I mean, it would be great to win the million dollars, but I would also like not to lose my life during this race because somebody else's vehicle --

PANEL: Let us have the survey team investigate that and see that -- you know, there is all kinds of terrain that they are looking at, and there are all kinds of possible speeds that can be attained on that terrain. So why don't we just investigate that. Safety, as we all say, is the number-one concern here. That is a valid point. So let us look at that and see if a speed limit of some sort would not harm the challenge, but would enhance safety.

QUESTIONER: I guess probably a follow-up to that would be that a vehicle -- I don't know how exactly you would do this, but a vehicle would be rated. In other words, your team would look at a vehicle and basically say based upon the safety equipment on board, based upon the stability of the vehicle, it can go up to a certain speed and still reliably keep everybody else that is on the race course safe. So it is just a thought.

PANEL: Okay. We will take a look at that.

QUESTIONER: Listen, we have come to the conclusion of our Q&A, and I would like to thank the panelists and really the team members here. [Applause.] I probably owe several of you several drinks. So please join me upstairs later on this afternoon, but at this time, what I would like to do is we have got a press conference upstairs at 1300. So I would like for the panelists to walk down the middle of the aisle and head that way.

I would like for the folks here, remain here. I am going to turn the program over to Rob McHenry. He is going to talk to you about this afternoon and what your expectations can be for this afternoon.

So, Rob, you have got it.

[Applause.]

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